SESSION 1.2

Multiplying a Whole Number by a Fraction

MATH FOCUS POINTS

- Using a representation to multiply a fraction and a whole number
- Extending understanding of the operation of multiplication to include fractions
- Writing multiplication equations for multiplying a fraction and a whole number

TODAY'S PLAN		MATERIALS
10 Class	TEN-MINUTE MATH: REVIEW AND PRACTICE *Practicing Place Value*	Teacher Presentation
40 Class, Pairs	1 ACTIVITY The Big Bicycle Race	Teacher Presentation *Student Activity Book*, pp. 427–429 T72*
20 Class	2 DISCUSSION Writing Equations	T72 (from Activity 1)
	SESSION FOLLOW-UP: REVIEW AND PRACTICE Daily Practice and Homework	*Student Activity Book*, pp. 430–431

* See *Materials to Prepare* in the Investigation 1 Planner.

Common Core State Standards	**Ten-Minute Math:** 5.NBT.A.3a, 5.NBT.A.4, 5.NBT.B.7 **Session:** 5.NF.B.4a, 5.NF.B.6	**Daily Practice:** 5.NBT.A.3b

TEN-MINUTE MATH: REVIEW AND PRACTICE

Practicing Place Value

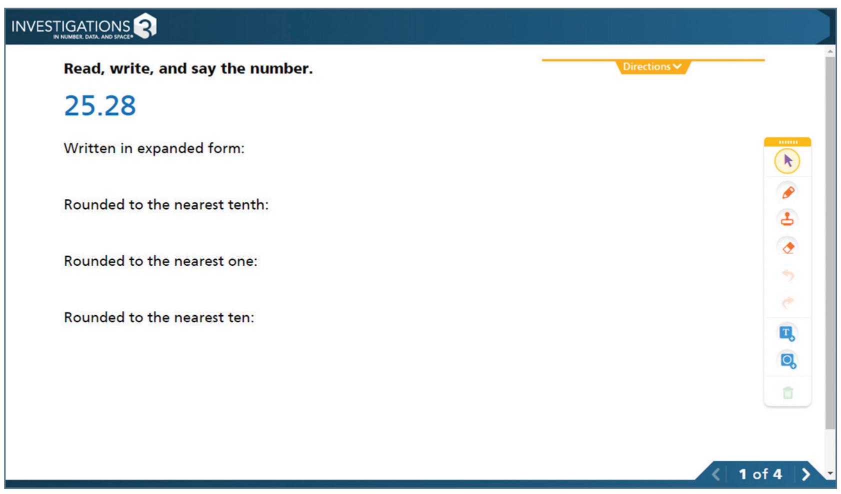
10

MATH FOCUS POINTS

- Reading, writing, and rounding decimals
- Writing decimals in expanded form
- Adding tenths and hundredths to, and subtracting them from, decimals

Say "twenty-five and twenty-eight hundredths," and have students write the number. Make sure that all students can read and write this number correctly.

Display the Teacher Presentation or write the number 25.28.



Ask students to write the number in expanded form. $\left(2 \times 10 + 5 \times 1 + 2 \times \frac{1}{10} + 8 \times \frac{1}{100}\right)$ Make sure that all students agree that this notation (with or without parentheses) is correct. Discuss any disagreements as a class.

What is 25.28 rounded to the nearest tenth? (25.3) **Nearest one?** (25) **Nearest ten?** (30)

Ask students to solve these problems mentally:

What is 25.28 + 0.8? (26.08) **25.28 + 0.08?** (25.36) **25.28 – 0.08?** (25.2) **25.28 – 0.8?** (24.48)

Display each answer. Ask students to compare each sum or difference with 25.28.

Which places have the same digits? Which do not? Why?

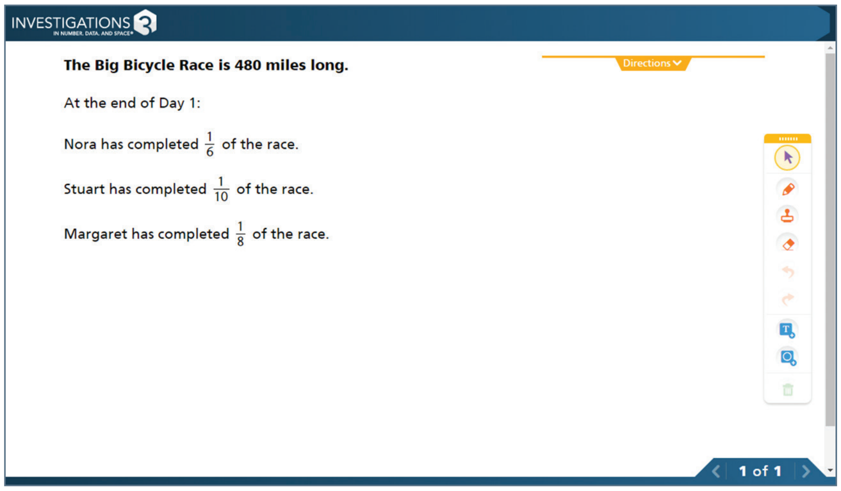
If time remains, pose additional similar problems using 53.14.

1 ACTIVITY

The Big Bicycle Race

40

Display the Teacher Presentation or write the information shown.



Think about this problem:

Nora, Stuart, and Margaret are long-distance bicycle racers. They enter long races that last several days. This year they are entering the Big Bicycle Race. The total distance they have to bike is 480 miles. Each day, they are allowed to race for 6 hours, and each evening is a rest period. The information on the board explains how far each person has cycled at the end of Day 1.

First, let's use what we already know about comparing fractions to think about who is winning the race at the end of Day 1. Who's in first place and who's in last place? How do you know? Turn and talk to a neighbor about this. Use what you know about comparing fractions.

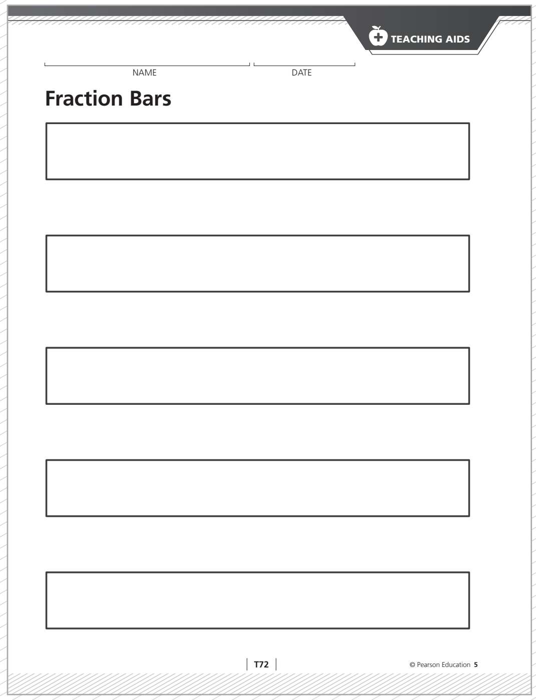
Gather responses and discuss. Students should recognize that because $\frac{1}{6}$ is the greatest fraction, Nora is winning at the end of Day 1. They should use similar reasoning to explain why Stuart is in last place. $\left(\frac{1}{10}\right.$ is the smallest of the three fractions.$\left.\right)$

What if we wanted to know exactly how many miles each person has cycled? Remember, the whole race is 480 miles long. Let's start with Nora. If she has completed $\frac{1}{6}$ of the race, how many miles did she ride? How could we figure out $\frac{1}{6}$ of 480? Turn and talk to a neighbor about how you might solve this problem.

Some of you have already found the answer to this problem. Let's also think about a way to represent this problem.

Distribute copies of Fraction Bars (T72) and display a copy of T72. TN

RESOURCE MASTERS, T72


TEACHING AIDS

NAME DATE

Fraction Bars

T72

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TEACHING NOTE

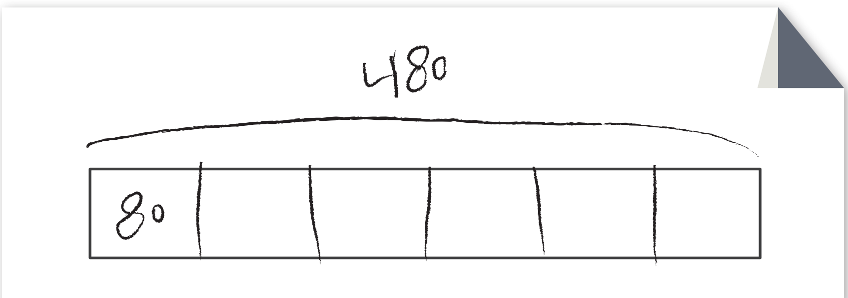
TN Using the Fraction Bar It is important in these early sessions of the investigation to establish and use the fraction bar as a representation. Some students may want to use a number line to solve these problems. Acknowledge that the number line is a representation that works to find the solutions to these problems, but ask students to also use the fraction bar. The fraction bar is used in Sessions 1.5 and 1.6 to represent multiplying a fraction by a fraction, and it is important that students have experience with the fraction bar before those sessions.

We're going to use these fraction bars during the next few sessions. For this problem, the length of each bar represents the whole race—480 miles. Work with a neighbor to show how far Nora has gone at the end of Day 1. MPN

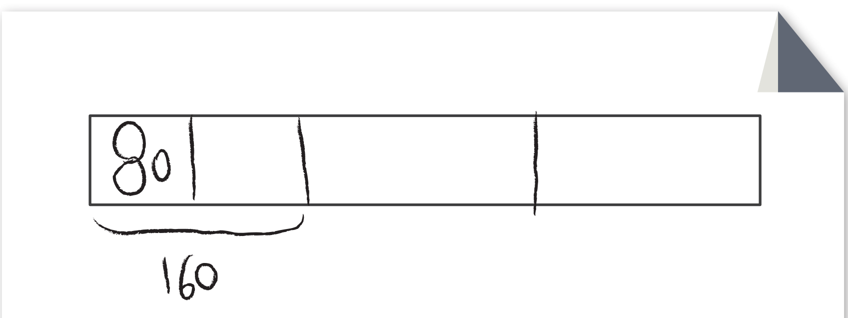
Give students a minute or two to work on this problem. Then ask students to share their solutions and explain their thinking.

STUDENTS MIGHT SAY

"Since Nora had gone $\frac{1}{6}$ of the race, we divided the bar into 6 equal pieces. Since each piece shows the same amount, we divided 480 by 6, and that's 80. So $\frac{1}{6}$ of the race is 80 miles."



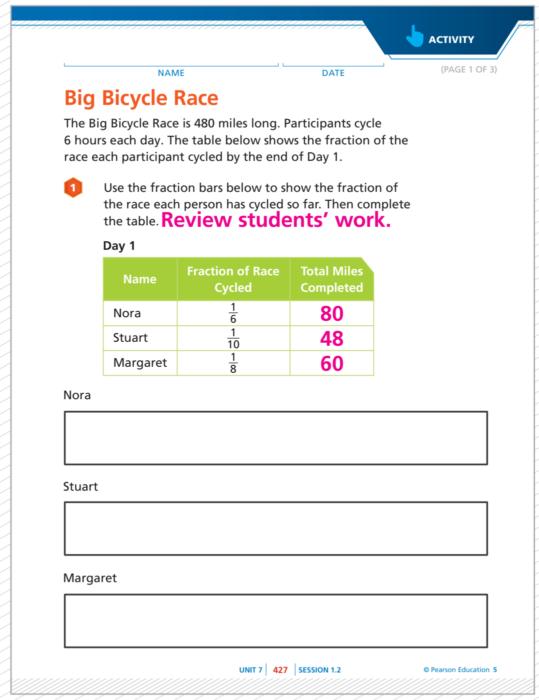
"First we divided the bar into thirds because that seemed an easy way to start, and we had to figure out how many miles that was. We divided 480 by 3, and that's 160. We know $\frac{1}{6}$ is a half of $\frac{1}{3}$, and half of 160 is 80. The answer is 80 miles."



Record one solution, and save the recorded solution for the discussion at the end of the session.

Ask students to look at *Student Activity Book* pages 427–429 and see what they notice. Point out that there is no table for Day 3 and that students are expected to use the fraction-bar representations to solve the problems.

STUDENT ACTIVITY BOOK, P. 427



ACTIVITY

NAME DATE (PAGE 1 OF 3)

Big Bicycle Race

The Big Bicycle Race is 480 miles long. Participants cycle 6 hours each day. The table below shows the fraction of the race each participant cycled by the end of Day 1.

1 Use the fraction bars below to show the fraction of the race each person has cycled so far. Then complete the table. **Review students' work.**

Day 1

Name	Fraction of Race Cycled	Total Miles Completed
Nora	$\frac{1}{6}$	80
Stuart	$\frac{1}{10}$	48
Margaret	$\frac{1}{8}$	60

Nora

Stuart

Margaret

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MATH PRACTICE NOTE

MPN **MP2 Reason abstractly and quantitatively.** Abstracting the mathematical meaning from a context allows students to express the actions described in the problem using numbers and operations. In this activity, students solve a set of bicycle race problems. Moving among the story context, the representation, and the equations helps students express the relationships between the quantities. Ask questions to support students in explaining how their solutions make sense in terms of the original problem context.

ONGOING ASSESSMENT Observing Students at Work

Students solve multiplication problems involving fractions and whole numbers.

- **How are students dividing the fraction bars?** Do students understand that the fraction bars should be divided into equal parts? Are students using the relationship between sixths and thirds; between fourths, eighths, and sixteenths?
- **How are students solving the problems?** How are students using the fraction bars to help them solve the problems? For example, to find $\frac{1}{8}$ for Margaret for Day 1, are they dividing the bar into halves and showing that $\frac{1}{2}$ is 240 miles, into fourths and showing that $\frac{1}{4}$ is 120 miles, and into eighths and showing that $\frac{1}{8}$ is 60 miles? Are they dividing 480 by the denominator to determine the total miles completed? **MP1**
- **Are students noticing the relationship between the problems?** For example, for Day 2, do they think about $\frac{1}{3}$ or $\frac{1}{4}$ as being twice as far as $\frac{1}{6}$ or $\frac{1}{8}$? Or that $\frac{3}{10}$ is 3 times as far as $\frac{1}{10}$?

DIFFERENTIATION Supporting the Range of Learners

INTERVENTION **Adapt the Problem** Some students may not know how to approach solving these problems. Ask these students to work only on Day 1.

EXTENSION **Adapt the Problem** For students who quickly solve all of the problems, ask them to estimate the fraction of the race each participant had cycled on Day 3.

ENGLISH LANGUAGE LEARNERS **Partner Talk** Have partners discuss how they are using the fraction bars to help them solve the problems. Provide prompts to stimulate partner discussions. For example: **What does this whole fraction bar represent?** (the total distance of the race, which is 480 miles) **Why did you divide the fraction bar into [halves]? What did you do next? Why? Why did you divide the fraction bar into [six] equal parts?**

2 DISCUSSION

Writing Equations

20

MATH FOCUS POINT FOR DISCUSSION

- Writing multiplication equations for multiplying a fraction and a whole number

Display the copy of Fraction Bars (T72) you saved that showed a solution for $\frac{1}{6}$ of 480.

At the end of Day 1, Nora had completed $\frac{1}{6}$ of the race. You figured out that was 80 miles.

STUDENT ACTIVITY BOOK, P. 428

ACTIVITY

NAME DATE (PAGE 2 OF 3)

Big Bicycle Race

2 Use the fraction bars below to show the fraction of the race each person has cycled so far. Then complete the table. Remember, the race is 480 miles long.

Review students' work.

Day 2

Name	Fraction of Race Cycled	Total Miles Completed
Nora	$\frac{1}{3}$	160
Stuart	$\frac{3}{10}$	144
Margaret	$\frac{1}{4}$	120

Nora

Stuart

Margaret

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STUDENT ACTIVITY BOOK, P. 429

ACTIVITY

NAME DATE (PAGE 3 OF 3)

Big Bicycle Race

3 Use the fraction bars below to show the fraction of the race each person has cycled so far. Then complete the table. Remember, the race is 480 miles long.

Day 4

Name	Fraction of Race Cycled	Total Miles Completed
Nora	$\frac{5}{6}$	400
Stuart	$\frac{7}{10}$	336
Margaret	$\frac{9}{16}$	270

Nora

Stuart

Margaret

UNIT 7 | 429 | SESSION 1.2 © Pearson Education 5

Write:

$$\frac{1}{6} \text{ of } 480 \text{ miles is } 80 \text{ miles.}$$

How would you write this as an equation? Talk to a neighbor and come up with an equation.

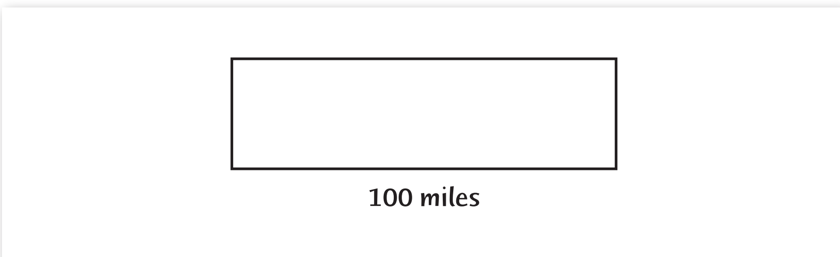
Gather students' ideas. It is likely a student will suggest the equation $480 \div 6 = 80$. Acknowledge that this equation correctly represents the situation.

But what if you use the numbers $\frac{1}{6}$, 480, and 80? Those are the numbers used on *Student Activity Book* page 427. How can you write an equation using these three numbers to represent the situation?

Record suggestions. Take a few minutes for students to explain their ideas. It is likely that not all students will understand why this problem is a multiplication situation. MPN PD

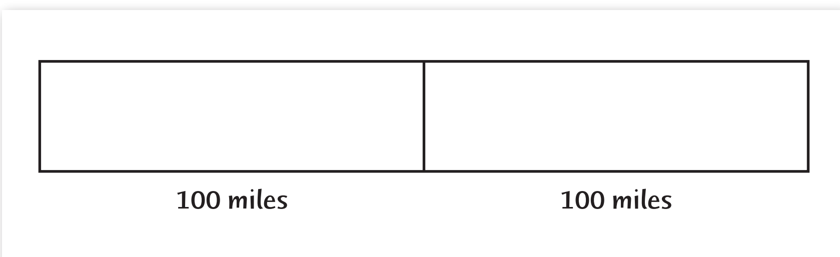
Let's look at a bike race with whole numbers and then come back to fractions.

Draw a rectangular bar, and explain that this time, the race is 100 miles long.



This bar represents a race of 100 miles. What if [Olivia] biked 2 of these races? How would you show that?

Draw two bars:



How would you write an equation to show the total distance [Olivia] biked in two races?

Record:

$$2 \times 100 = 200$$

Where is the 2 in this representation? The 100? The 200? What if [she] biked one of these races? What would the picture look like? What would the equation be?

MATH PRACTICE NOTE

MPN **MP4 Model with mathematics.** As they model with mathematics, students identify the mathematical elements of a situation and create an equation that shows the relationships among those elements. In this discussion, students solve bicycle race problems and determine how different equations can model the same situation. For example, both $\frac{1}{6} \times 480 = 80$ and $480 \div 6 = 80$ can model the part of the bicycle race Nora completed.

PROFESSIONAL DEVELOPMENT

PD DIALOGUE BOX 1: Why Can We Write $\frac{1}{6}$ of 480 as $\frac{1}{6} \times 480$?

Record:

$$1 \times 100 = 100$$

What if [Olivia's] bike broke down, and [she] could bike only half of the 100-mile race? What would the picture look like?

Discuss the equations for the other problems and their connections to this problem.

For 2 races of 100 miles each, we write 2 times 100. For 1 race of 100 miles, we write 1 times 100. What connection do you see between these problems and the problem about $\frac{1}{2}$ of a race of 100 miles?

STUDENTS MIGHT SAY

"For each one the person is doing some amount of the race: 2 of the races, 1 of the race, $\frac{1}{2}$ of the race."

"I am thinking about groups. It's not really groups of the race, but it kind of is: the person does 2 of the 100 miles, 1 of the 100 miles, or $\frac{1}{2}$ of the 100 miles."

What equation would I write for the problem about [Olivia] only biking half of the 100 mile race?

Students may suggest $100 \div 2 = 50$ or $\frac{1}{2} \times 100 = 50$. Write $\frac{1}{2} \times 100 = 50$. Discuss how this equation matches the problem.

Highlight that when using fractions, a fraction *of* an amount indicates multiplication. Just like 2 groups *of* something is multiplication, $\frac{1}{2}$ group *of* something is also multiplication. PD

Display again the copy of Fraction Bars (T72) showing $\frac{1}{6}$ of 480. Write $\frac{1}{6} \times 480 = 80$ underneath the fraction bar. MWI

Let's look at this solution one more time. Where do you see 480 in the representation? $\frac{1}{6}$? 80?

In the last session you also solved problems about biking and running distances.

Read Problem 1 from *Student Activity Book* page 421:

There is a $\frac{2}{3}$-mile loop around a pond near Renaldo's house. On Monday he ran around the loop 4 times. How many miles did he run?

How were those problems different from the ones you solved today?

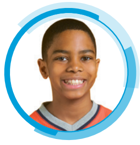
PROFESSIONAL DEVELOPMENT

PD **TEACHER NOTE 1:** Multiplying with Fractions

MATH WORDS AND IDEAS

MWI Multiplying Whole Numbers, Fractions, and Mixed Numbers

STUDENTS MIGHT SAY



"In the last session the distances were much shorter. They were going $\frac{3}{4}$ of a mile and $\frac{1}{2}$ mile, but they were doing it a lot of times. In these problems the distances are long, but they are only biking part of them."

"In the last one we were finding groups of a fraction. Today we were finding fractions of a group."

"The equations are a little different. For these problems the fraction came first because we were finding fractions of a number. Yesterday the whole number came first because we were finding groups of a fraction."

In the next few sessions you are going to continue working on multiplying whole numbers and fractions. You will also multiply whole numbers and mixed numbers.

SESSION FOLLOW-UP: REVIEW AND PRACTICE

Daily Practice and Homework

DAILY PRACTICE For ongoing review, students complete *Student Activity Book* page 430.

HOMEWORK On *Student Activity Book* page 431, students use fraction bars to represent fractions of a distance.

STUDENT ACTIVITY BOOK, P. 430

DAILY PRACTICE

NAME DATE

Comparing Batting Averages

Who had the better batting average? Circle the higher batting average.

1. Ted Williams: .344; or Lou Gehrig: .340
2. Joe DiMaggio: .325; or Willie Mays: .302
3. Hank Aaron: .305; or Babe Ruth: .342
4. Ty Cobb: .366; or Rogers Hornsby: .358
5. Rod Carew: .328; or Stan Musial: .331
6. Reggie Jackson: .262; or Yogi Berra: .285
7. Mickey Mantle: .298; or Johnny Bench: .267
8. Roberto Clemente: .317; or Jackie Robinson: .311

NOTE

Students review comparing decimals.
MWI **Comparing and Ordering Decimals**

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STUDENT ACTIVITY BOOK, P. 431

HOMEWORK

NAME DATE

Take a Hike

Deon hiked the Green Mounds Trail, which is 16 miles long. The table shows Deon's progress during the hike.

Use the fraction bars below to show the fraction of the trail Deon had hiked at different times. (Each fraction bar represents 16 miles.) Then complete the table.

Time	Fraction of Trail Hiked	Total Miles Completed
10:00 A.M.	$\frac{1}{8}$	2
Noon	$\frac{1}{2}$	8
2:00 P.M.	$\frac{3}{4}$	12

10:00 A.M. **Review students' work.**

Noon

2:00 P.M.

NOTE

Students use fraction bars to represent fractions of a distance.
MWI **Multiplying Whole Numbers, Fractions, and Mixed Numbers**

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